MATERIAL MACHINING BELTS, ESPECIALLY GRINDING AND/OR POLISHING BELTS, AND METHOD FOR PRODUCTION OF MATERIAL MACHINING BELTS

FIELD OF INVENTION

The present invention concerns material machining belts, especially grinding and/or polishing belts, for releasable attachment to the outer surface of a grinding roll, and a method for production of material machining belts.

Background OF THE Invention

A generic material machining belt, especially a grinding or polishing belt, has a working surface, a first and second end, as well as an end connection device for formation of an endless belt.

Such grinding or polishing belts are used in the form of endless belts closed into rings for grinding or polishing of round pipes, round wood, or etc. For this purpose, the grinding belt is positioned with an inward facing working surface, on the one hand, around the workpiece being machined and, on the other hand, placed directly around a grinding belt drive roll of a belt grinding machine. During grinding, the grinding belt ring is tightened, in which the operator pulls the drive device with the drive roll away from the workpiece. In order to be able to machine closed workpieces, however, in which slipping on of the closed grinding belt ring is not possible, the grinding belt must be undone, in order to position the object being machined, and then closed again into a ring.

One possibility of reconnecting the open grinding belt consists of gluing the belt, assembled into a ring, over its entire length with a special fabric belt. This solution is very effective and reliable, albeit time-consuming. In addition, significant amounts of additional fabric belt are required.

Finally, a two-layered belt is known from WO 9738825, which consists of an inner lying support belt rigidly closed into a ring and an outer, releasably mounted grinding belt. The belt is placed on two rolls of a grinding machine at a spacing from each other, in which the grinding surfaces lie on the outside. The two ends of the grinding belt are formed complementarily, in order to form a shape-mated connection with a flush, flat joint. Because of the system, inside grinding and therefore grinding of closed workpieces is not possible.

Another possibility of reclosing an opened grinding and polishing belt into an annular endless belt is known from WO 97/20663. In the grinding and polishing belts described there, it is proposed, for joining of the ends, not to glue the entire belt, but only a comparatively short partial section in the vicinity of the ends.

Good results are already achieved with this solution. However, an adhesive strip is required for reclosing, as well as a cutting tool for opening. The adhesive joints are also not recloseable repeatedly, with the result that a new piece of adhesive tape is frequently required.

Summary of the Invention

The underlying objective of the invention is to offer a material machining belt, especially a grinding or polishing belt that can be easily separated and reclosed to an annular endless belt, and that overall has a longer service life. A method for production of such material machining belts is also to be offered.

This objective is realized with a material machining belt with the features of the independent claims, as well as a method for production of material machining belts with the features of the independent process claim.

Advantageous modifications and variants of the material machining belts according to the invention and the methods for their production are described in the independent claims.

It is proposed according to the invention of the material machining belt of the initially mentioned type that the connection device be designed as a releasable shape-mated connection device with at least one recess with a closed edge on the first end, as well as at least one counterpiece on the second end. Thus, loosening of the connection during transfer of the rotational movement from the grinding roll during the grinding process is also reliably prevented at high tensile forces.

A key idea of the invention is seen in the fact that closure of the two ends of a material machining belt occurs by means of a shape-mated joint, in which the closed edge of the opening prevents widening of the opening when tension is exerted on the material machining belt during operation. Surprisingly, it has been shown during tests that material machining belts whose ends are joined by a shape-mated joint have extremely good running properties. In comparison with a glue joint, the transition of the joint is softer, so that the presence of the transition site is scarcely noticed during operation.

A significant advantage of the solution according to the invention is also the fact that the shape-mated joint can be loosened and reclosed as often as desired. No additional materials and/or tools are necessary to make and open the joint. In particular, this also means that no waste is formed. Opening and closing of the shape-mated joint can also be carried out very quickly, which is also a significant benefit in practice.

Finally, it is also advantageous that the material machining belts need not be preclosed, but can be shipped and stored in space-saving fashion in the opened state.

In addition, in a material machining belt, especially a grinding and/or polishing belt according to the present invention, it is expedient that a first working surface and a second working surface on the side opposite the first working surface be present, wherein the first working surface lies on the outside in a first state of the material machining belt, whereas in a second state of the material machining belt, the second surface lies on the outside, and wherein the material machining belt can be reversibly brought from the first state to the second state.

This material machining belt is advantageous, especially in conjunction with a releasable shape-mated joint, in that the material machining belt can then be opened very easily and quickly and subsequently reclosed so that the necessary working surfaces come to lie on the inside.

A significant advantage of this type of material machining belt is also the fact that virtually the entire surface can be used as a working surface. Thus, the service life of such a material machining belt is increased and material costs can be saved.

Finally, in a method for production of material machining belts from belt piece goods, it is proposed according to the invention that a first and second blank of the material machining belt be made from adjacent pieces of the belt piece goods, and that, in a common processing step, at least one recess is incorporated in the first blank by means of one or more punching tools and at least one counterpiece in the second blank.

The basic idea here is that two adjacent blanks on the belt piece goods for material machining belts are processed in a single step, in order to accelerated the manufacturing process.

In particular, time-intensive and equipment-intensive adjustment and tightening processes, as well as adjustments of the tools, can be saved with this process. Fewer rejects and only extremely limited material waste are also produced in the process according to the invention.

The invention can be modified advantageously in that, on the first end, at least two recesses and, on the second end, a corresponding number of counterpieces are provided. Thus, the tensile forces loading the joint during operation are distributed over several shape-mated joints. This can be a particular advantage in comparatively wide grinding or polishing belts.

In a preferred embodiment of the material machining belts, at least one of the recesses is designed in the form of a hole with a closed edge and at least one of the counterpieces is designed in the form of a head. This affords a particularly easy and rapid release and reclosing, as well as high loading ability during the operation. Here, a design in the form of a head is to be understood to mean a shape that consists of a terminal widening, the "head," and a neck-like constriction.

This type of material machining belt can be modified advantageously in that the recess is designed as an elongated hole in the belt longitudinal direction, and that the length of the hole corresponds roughly to the width of the "head." For closure of the joint, the second end with the counterpiece can then be simply pushed into the hole on the first end.

In this case, it is particularly preferred to design the material machining belt so that the hole has a first and second region, where the expansion of the first region is greater in the transverse direction of the material machining belt than that of the second region.

It is also advantageous in this connection if the hole be made so that the first region faces the first end and the second region faces away from the first end. Finally, it is expedient that the counterpiece be formed so that material recesses are incorporated on the second end on both long sides on opposite sites.

With a hole and counterpiece formed in the aforementioned manner, closing of the shape-mated joint occurs roughly as follows: initially, the second end is introduced into the elongated hole until the material recesses on the second end lie in the plane of the first end. The second end is then pushed into the hole until the neck, produced by the material recesses, is situated in the first region of the hole, whose recess in the transverse direction of the material machining belt is preferably chosen sufficiently large that the shape-mated joint can be produced by rotation of the second end in the hole.

For a case in which the support material of the material machining belt has mechanical properties that do not permit sufficient stability of a shape-mated joint consisting of a recess and counterpiece, it can be advantageous to stiffen a surrounding region of at least one recess and/or at least one counterpiece.

This can be achieved expediently in that by coating the surrounding region of at least one of the recesses and/or at least one of the counterpieces with a hardening agent for stiffening.

In order to further facilitate loosening and closing of the shape-mated joint, it can also be advantageous to round the edges and/or the corners of the material machining belts. Thus, introduction of the second end into the elongated hole and rotation in the hole are somewhat facilitated.

The presence of two working surfaces in the material machining belts permits a situation in which the first working surface is designed as a grinding surface and the second working surface as a polishing surface. This type of material machining belt, especially when it is additionally equipped with a rapidly and easily releasable shape-mated joint, is an extremely practical tool, since in many working processes grinding must initially occur, followed by polishing. With the present material machining belt, a grinding and polishing belt is available in one piece.

For other applications, however, it can be preferred that both the first and second working surfaces be designed as grinding surfaces or as polishing surfaces. Such material machining belts are preferred, for example, if very large surfaces must be ground or polished, i.e., if the wearing out of at least one working surface during the machining process must be reckoned with. Not only must a second material machining belt then be supplied and incorporated, but after the wearing out of the first machining surface of a material machining belt, this must be turned once and the second working surface then used.

In similar fashion for certain areas of application, material machining belts can also be useful, in which the first and second working surfaces are designed as grinding surfaces with different grain sizes or polishing surfaces of different levels of fineness.

A preferred refinement of the process according to the invention consists of the fact that the first blank and the second blank are separated from each other after execution of the joint processing step. For example, if the edges of the punched-in holes and material recess are to be rounded in an additional processing step connected to the joint processing step, it can be advantageous if the two blanks remain unseparated from each other.

However, if additional processing steps are not prescribed during production of the material machining belts, it can be expedient to separate the first blank and second blank in the joint processing step.

When a comparatively tough or hard material is involved in the employed belt piece goods, it can be desirable to reduce the force necessary for punching. This can be done by performing the punching process with a time offset to distribute the force necessary for punching.

In preferred embodiments of the method according to the invention, one of the materials, felt or conveyor belt, textile belt with an abrasive particle coating, a composite material with a glass filament layer and a nylon nonwoven layer, which is impregnated with abrasive particles, or a composite material with two grinding belts, whose backs are glued together, is used as belt piece goods.

If the recess or counterpiece does not exhibit sufficient mechanical strength, a modification of the process can be preferred, in which, in the surrounding region of at least one recess and/or at least one counterpiece, a hardening agent is applied for stiffening. This can occur, for example, by dipping the ends of the blanks into a corresponding agent, such as bone glue, a phenolic resin, etc.

BRIEF DESCRIPTION OF THE DRAWINGS

The invention is further explained below with reference to the figures. In the figures:

Figure 1 schematically depicts three embodiment examples of holes on the first end of a material machining belt according to the invention;

Figure 2 schematically depicts three embodiment examples for counterpieces on the second end of a material machining belt according to the invention;

Figure 3 schematically depicts an example of the material machining belt according to the invention with two recesses on the first end and two counterpieces on the second end;

Figure 4 schematically depicts a cross section through a material machining belt according to the invention with two working surfaces; and

Figure 5 schematically depicts a perspective view of a grinding belt joined into a ring.

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Detailed Description

Figure 1 shows, at a, b and c, three embodiment examples of recesses 11 on the first end 5 of a material machining belt 1 according to the invention. The recesses 11, in the form of an eye, are formed as holes of different shape and a closed edge. They each have the shape of an elongated hole, the longitudinal axis 25 of the hole lying parallel to the long sides 27 of the material machining belt 1, and the lengths 21 of the hole corresponding to roughly the width 23 of the material machining belt 1.

Each of the holes also has a first region 29 and a second region 31. The expansion 37 of the first region 29 in the transverse direction of the material machining belt 1 is then greater than the expansion 35 of the second region 31. The first region 29, which has the greater expansion 37, faces the first end 5, and the second region 31 accordingly faces away from the first end 5. In the example shown in 1a, the first region has the shape of a round hole and the second region the shape of an elongated hole. In the embodiment example shown in 1b, the hole has a T shape. Finally, an example of a hole is shown in Figure 1c that has essentially the shape of a trapezoid. The expansion of the hole in the transverse direction of the material machining belt 1 is smaller with increasing distance from the first end 5.

Three examples of possible head-like counterpieces 13 for the recesses 11 from Figure 1 are shown in Figure 2 in a, b and c. Equivalent parts are provided in Figures 1 and 2 with the same reference numbers. Each of the counterpieces shown in Figure 2 is connectable to each of the recesses 11 shown in Figure 1. The counterpieces 13 on the second end 7 of a material machining belt are each formed by material recesses 39 that are made in the opposite sites on the long sides 27 of the material machining belt 1. A neck-like constriction is formed by the material recesses 39. The depicted variants differ in shaping of the material recesses 39, which are configured semicircularly in 2a, rectangularly in 2b and trapezoidally in 2c.

Shape-mated connections of different strength can be achieved with the different shaping of recess 11 and counterpiece 13 and by the combination of different variants.

An example of a material machining belt 1, in which a shape-mated joint can be produced by means of two recesses 11 on the first end 5 and with two head-like counterpieces 13 on the second end 7, is shown in Figure 3.

In relatively wide material machining belts 1, a uniform distribution of the forces that load the shape-mated joint during operation can be achieved.

Figure 4 shows an example of a material machining belt 1 with a first and a second working surface 15 and 17. The material machining belt 1 consists of two textile belts 51, covered with a first and second grinding grain layer 53 and 55. The first working surface 15 is formed by the first grinding grain layer 53, and the second working surface 17 by the second grinding grain layer 55. The textile belts 51 are joined together by a glue layer 49 on the opposite sides on grinding grain layers 51 and 53.

Figure 5 shows a material machining belt 1 in the operating state. The material machining belt 1, closed into a releasable ring, is placed, on the one side, on a working roll 2 of a grinding machine (not shown) and, on the other side, around a workpiece 4 with a round cross section. The effective working surface 53 of the grinding belt 1 is turned inward.

The shape-mated joint of the two free ends 5, 7 of grinding belt 1 is produced by the fact that the head-like counterpiece 13 on the second end 7 is pushed through the recess 11 on the first end 5 from the inside and outside. Since the two free ends of the grinding belt 1 are directed outwardly, the transition on the inward lying working side is flush and smooth. The joining site therefore creates no jerks during revolution around the workpiece 4. In order to obtain the desired contact force of the grinding belt 1 on workpiece 4, the drive rolls 2 and the grinding machine are pulled away from the workpiece by the operator in the direction of arrow 6.